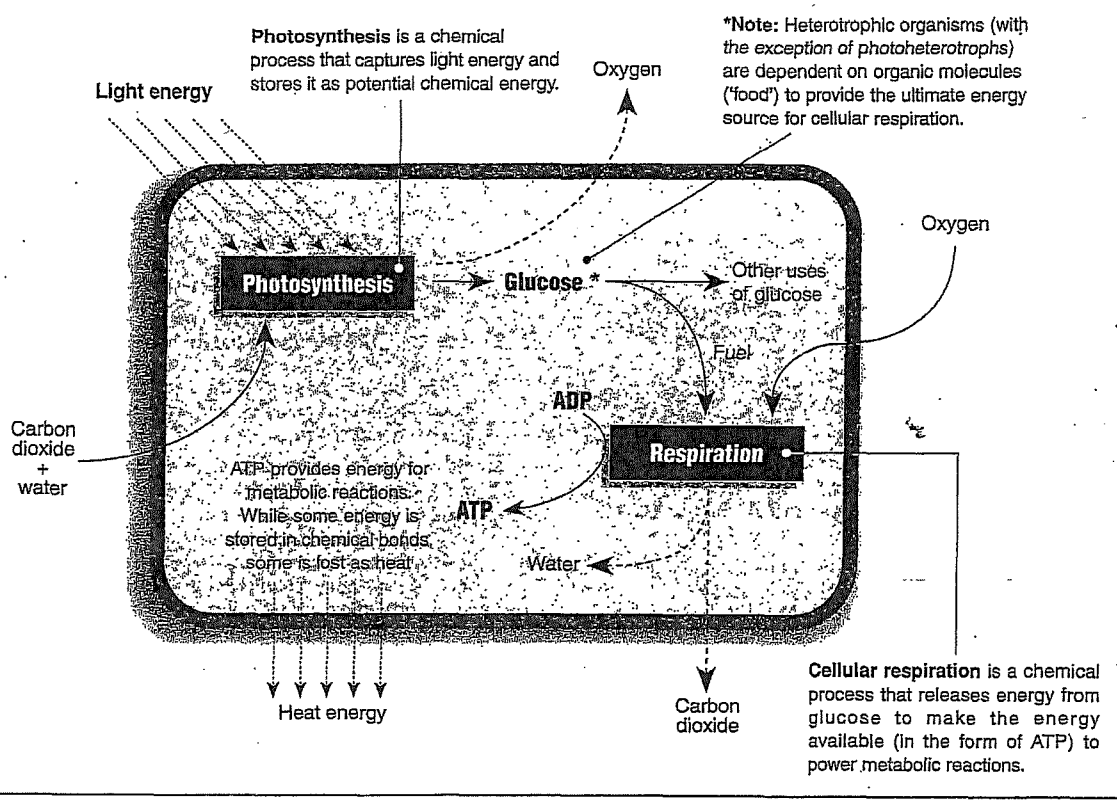
RA 2

Energy in Cells

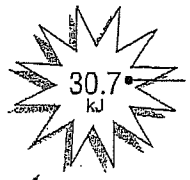
A summary of the flow of energy within a plant cell is illustrated below. Animal cells have a similar flow except the glucose is supplied by eating instead of photosynthesis. Note that energy is ultimately used to make energy rich molecules or is lost as heat energy. The role that ATP molecules play in the energy conversion processes is illustrated on the next page.

Summary of Energy Transformations In a Photosynthetic Plant Cell



The role of ATP in cells

The molecule **ATP** (adenosine triphosphate) is the universal energy carrier for the cell. ATP can release its energy quickly; only one chemical reaction (hydrolysis of the terminal phosphate) is required. This reaction is catalyzed by the enzyme ATPase. Once ATP has released its energy, it becomes ADP (adenosine diphosphate), a low energy molecule that can be recharged by adding a phosphate. This requires an input of energy that is supplied by the controlled breakdown of **respiratory substrates** in the process of cellular respiration. The most common respiratory substrate is glucose, but other molecules (e.g. fats or proteins) may also be used.



Energy released
The energy released from the release of a phosphate is available for immediate work inside the cell (e.g. powering chemical reactions).

P

A free phosphate is released from the ATP (this may be *reused later to regenerate* ADP into ATP again).

In the presence of the enzyme **ATPase**, the ATP molecule loses a phosphate.

Adenosine – P – P – P

Adenosine triphosphate

ATP

A high energy compound able to supply energy for metabolic activity.

Adenosine – P – P

Adenosine diphosphate

ADP

A low energy compound with no available energy to fuel metabolic activity.

Mitochondrion

Cellular respiration
Cellular respiration represents an **oxidative**